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DEPARTMENT OF AGRICULTURE

BUREAU OF
ENTOMOLOGY AND PLANT QUARANTINE
NEWS LETTER

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UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

NEWS LETTER

FOR DECEMBER 1936

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FRUIT INSECT INVESTIGATIONS

Covering raisins reduces insect infestation.--Further evidence of the effectiveness of covering boxed raisins with shade cloth after cleaning them with a motor-driven shaker screen was obtained by H. C. Donohoe, of the Fresno, Calif., laboratory. Seedless raisins produced in three vineyards were screened and stored in boxes out-of-doors on the ranches for about 1 month. A part of each crop was covered only by a loose shield of trays to keep out rain; another portion of each lot was covered in the same way and then protected from insects by a sheet of shade cloth. The results, estimated from infestations found in samples of the raisins, were as follows:

Protection	Average infestation per ton by--		
	Raisin moth[1]	Indian-meal moth[2]	Total
After drying, before screening------	27,800	800	28,600
Immediately after screening---------	5,400	200	5,600
After storage in unprotected boxes--	--	--	21,700
After storage in boxes covered with shade cloth----------------------	--	--	1,600

[1] *Ephestia figulilella* Greg.

[2] *Plodia interpunctella* Hbn.

An outbreak of the grape leaf folder.--Perez Simmons, Fresno, reports that the exceptional abundance of *Desmia funeralis* Hbn. in several areas in the San Joaquin Valley resulted in considerable damage by larvae, apparently of the third brood. In some vineyards most of the leaves were rolled and fed upon and extensive damage to fruit was observed by H. C. Donohoe during the period from September 24 to October 23. Sample counts of bunches showed damage to 66, 73, and 55 percent. Mr. Donohoe reports that parasitization of the late larvae by *Microbracon*, based on random counts in several locations, was 15, 69, 6, 24, 77, 99, 99 plus, and 100 percent. The parasite was probably *M. cushmani* Mues., as 15 specimens from one locality were all of that species. There was evidence that applications of calcium cyanide, put on by owners, had failed to control *Desmia* and had reduced parasite attack on the larvae. Two estimates of the population of pupae in leaves on the ground (October 15 and 23) gave 287,000 and 331,000 per acre. Parasitization of pupae by six or more species as yet not determined was 46.0°, 6.0°, and 1.5 percent. An attempt made by Mr. Donohoe to kill the pupae by burning the fallen leaves with a portable weed burner, using kerosene as fuel, was not successful. Applications of dichlorethyl ether solutions to the pupae, by Dwight F. Barnes and Charles K. Fisher, gave poor results when 5, 10, and 20 cc per gallon of water and 2 gallons of solution per square yard of soil were used.

Tree protectors not fully effective against peach borer.--Oliver I. Snapp and J. R. Thomson, Jr., of the Fort Valley, Ga., laboratory, have just completed the season's work with protectors to prevent Conopia exitiosa Say from entering peach trees. They report that neither the cotton-batting protector held snugly in place with screen wire nor the tar-paper cone sealed with tree tanglefoot prevented just-hatched peach borers from entering peach trees. These were the two most promising types of protectors used in the extensive tests of 1935. Twelve of the fourteen types of protectors tested in 1935 did not prevent just-hatched peach borers from entering peach trees. The results of the work with tree protectors during the last 2 years lead to the conclusion that there is very little possibility of developing a protector that will give 100-percent protection against the peach borer. This is due to the fact that just-hatched peach borer larvae will bore into the bark above a collar that may be a foot above the soil level and work down under the bark to the base of the tree if the collar extends that far; they may come out underneath the collar if it is only several inches wide and then crawl down the trunk under the protector to the base of the tree; or they may gain entrance to protected trees through cracks in the soil around the base of the protector.

Field tests with Japanese beetle repellents.--W. E. Fleming and F. E. Baker, of the Moorestown, N. J., laboratory, have completed a report on large-scale field tests, made during the 1936 season, of materials used for the protection of early ripening peaches and apples from injury by the adult Japanese beetle. Various combinations of derris were tested to ascertain whether any more satisfactory combinations than the derris-rosin residue emulsion combination now recommended could be developed. It was found that the derris-rosin residue combination was equally as good, if not superior to, any other derris combination for protection of early ripening peaches. For use on apples the lime-aluminum sulphate combination, as now recommended, was found to be the most satisfactory, and a single application at the beginning of the season was as effective as a double application.

Hibernation of Japanese beetle larvae.--T. N. Dobbins, Moorestown, reporting on the entrance of Japanese beetle larvae into hibernation, found from surveys made during December a decided decrease in the proportion of larvae entering hibernation in the second instar, and a corresponding increase in the number of larvae entering hibernation in the third instar, as compared with a year ago. About 10 percent of the present soil population will enter hibernation in the second larval instar, whereas a year ago (winter of 1935-1936) approximately 25 percent of the soil population entered hibernation in this instar. This condition is apparently due to the fact that soil temperatures during the fall of 1936 were, in general, somewhat higher than temperatures during the same period in 1935.

MEXICAN FRUIT FLY CONTROL

Status of project at the close of 1936.--Fruit shipments for the 1936-37 season from the lower Rio Grande Valley exceeded 7,100 cars by the end of December. This is approximately twice as much fruit as was shipped during the same period last season and is well in advance of any previous year. Eleven adult *A. ludens* Loew were trapped on 11 premises during December. The total number of adults trapped during this season is somewhat below that of 1935-36. The results of the project's activities for the month of December are summarized in the following table.

Item	December 1-15	December 16-31
Groves inspected	6,916	6,352
Premises trapped	300	304
Traps operated	5,736	5,761
Trap inspections made	9,815	13,388
Carloads released	1,027	950
Trucks released	2,725	2,840
Alternate host-fruit trees destroyed	1	3
Premises cleaned of host-fruit trees	1	2
Violations:		
On part of grower	2	10
On part of packer	1	10
Percentage of crop shipped	22	33
Approximate price per ton of fruit:		
Grapefruit	$8.50	$8
Oranges	15.00	14

The numbers of fruit flies submitted for identification and the source of capture were as follows:

Species	Texas		Mexico	
	Dec. 1-15	Dec. 16-31	Dec. 1-15	Dec. 16-31
Anastrepha ludens Loew	4	7	1	1
Premises	4	7	1	1
A. serpentina Wied	7	9	0	0
Premises	7	9	0	0
A. acidusa Walk	2	3	0	0
Premises	2	3	0	0
A. sp. "Y"	3	1	0	0
Premises	2	1	0	0
A. sp. "X"	--	1	--	0
Premises	--	1	--	0
A. pallens Coq	88	21	0	0
Premises	50	20	0	0
Toxotrypana curvicauda Gerst	5	1	0	0
Premises	5	1	0	0
A. sp. Seg. 3	--	1	--	0
Premises	--	1	--	0

During the period from December 1 to 15 no larvae were taken in Texas but 117 larvae of A. ludens and 20 larvae of A. striata Shin. were taken in Mexico, all in market fruit. No larvae were taken during the period from December 16 to 31 in either Texas or Mexico.

CEREAL AND FORAGE INSECT INVESTIGATIONS

Outbreak of corn earworm on wheat.--Severe damage to wheat by the corn earworm in the vicinity of Stockton, Kans., was observed early in October by H. H. Walkden, of the Manhattan, Kans., laboratory. It is believed that this outbreak on wheat is unique in the history of this species in the United States. A preliminary examination of the literature failed to disclose any records of injury to wheat in America, although the corn earworm is recorded as a pest of young wheat in Australia. Near Stockton approximately 300 acres of stubbled-in wheat was damaged, particularly in weedy areas in the fields where the predominating growth was pigweed (Amaranthus sp.). Evidently the adults had been attracted to the weeds at oviposition time, inasmuch as these were probably the only green plants present at the time the moths were depositing eggs. The larvae had stripped the foliage of the weeds and were forced onto the wheat by lack of food. It was apparent that the wheat was unpalatable and unsatisfactory as a food supply, as the larvae did not consume the plants but either ragged the leaves or bit off the plants at the soil surface where they were left uneaten. The larvae were much smaller than usual and adults which have been reared have only about half the normal wing spread.

Interesting food habit of false wireworm adults.--Mr. Walkden also reports that on September 21, 1936, in a stubble field near Meade, Kans., large numbers of false wireworm adults (Eleodes spp.) were observed congregated on the mounds of the red harvester ant. The ant hills were scattered throughout the field and on each of them the Eleodes beetles could be seen in great abundance. On closer examination, it was found that these beetles were devouring seeds that had been dropped here and there in the sand composing the mound. On several occasions, an ant returning to the nest with a seed would be set upon by a number of the beetles and robbed of its load of food. The ant promptly dropped its seed and attempted to defend itself by biting at the legs of the beetles; however, the colony in general was apparently not disturbed by the presence of the beetles. On September 22 very few beetles could be found in this field, but on October 8, near Stockton, Kans., Eleodes adults were observed about the ant hills stealing seeds from the ants in the same manner as had been observed at Meade.

Oxygen as a factor in vacuum fumigation.--R. B. Cotton, Geo. B. Wagner, and H. D. Young, Manhattan, report that in vacuum fumigation the susceptibility of insects to fumigants increases with the decrease in pressure. That this increase in susceptibility is due to oxygen deficiency and not to the difference in pressure was demonstrated by the following experiment. In a vacuum fumigation vault of 357.5 cubic foot capacity it was determined that, with an absolute pressure of 2½ inches and an air temperature of 64° F., a dosage of 10 pounds per 1,000 cubic feet of a 9-to-1 mixture of ethylene oxide and carbon dioxide gave a 100-percent kill of adults of the flour beetle (Tribolium confusum Duv.) with an exposure of 1 hour. A test was then conducted in the same vault at the same pressure, but with a different oxygen content. The air was pumped from the vault until an absolute pressure of 1/2 inch was obtained. Pure oxygen was then introduced into the tank until an absolute pressure of 2½ inches was obtained. Under these initial conditions exposure for 1 hour to a dosage of 10 pounds per 1,000 cubic feet of space of a 9-to-1 mixture of ethylene oxide and carbon dioxide at a temperature of 67° gave no kill of adult flour beetles. In both experiments the absolute pressure, the quantity of fumigant, and the length of exposure were the same. In the first experiment the oxygen content of the vault was reduced from the normal 21 percent to 1.76 percent, while in the second test the oxygen content was 7.26 percent. The calculations of the oxygen content of the vault in the two tests were based on a baremetric pressure of 29.7 inches, which obtained during the first test, and 29 inches during the second test. In the first experiment a slightly larger quantity of nitrogen was necessarily present in the vault but, since this gas is inert, this factor would have no influence on results.

Hessian fly resistance tests at Springfield, Mo.--According to E. T. Jones, Manhattan, of 61 selected strains, principally varieties of fall-sown spring wheat, 18 strains were found resistant to infestation by fall-brood hessian flies. Included in this resistant group are 3 varieties of wheat from Uruguay, 4 selections of Iumillo, 4 selections of Marquillo, 2 selections of Illinois No. 1 B38, Ill. No. 1 x (Norka x Carina), Ill. No. 1 W19, Marvel C.I. 8876, Kubanka C.I. 1440, and Yaroslav Emmer C. I. 1526. Based on 50 plant samples for each strain, the average infestation was 3.8 percent, as against averages of 76 percent for the 43 remaining spring wheats, 70 percent for the Ceres susceptible checks, and 3 percent for the Marquillo resistant checks. The best of this material will be used for developing resistant winter wheat hybrids. This test has also shown Iumillo to be the source from which selections of Marquillo have inherited resistance to hessian fly. The outstanding feature of our Springfield test

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wheat tests is a series of 326 F_5 selections of crosses involving Marquillo and desirable winter wheats--Kanred x Hard Federation, Minturki, Kawvale, Tenmarq, and Oro. Mention of the strong hessian fly resistance of F_3 and F_4 generation selections from which these F_5 hybrids have descended has been made in previous issues of the News Letter. Of the 326 strains, all comparably tested against their parental checks by natural infestation under field conditions in single 8-foot rows, 79 strains have been found to be free from infestation. A total of 235 strains fall within the same infestation range as the 15 Marquillo resistant parental checks, which have an average infestation of only 0.8 percent and a range of 0 to 8 percent. Since the average infestation of the 15 winter wheat parental checks is 84.5 percent and the range of infestation is from 69 to 94 percent, these results are considered highly significant.

JAPANESE BEETLE CONTROL

Certified Christmas plants move in increased volume.--Consistent and widespread demands for inspection and certification of Christmas plants reflected what is reported as one of the best holiday sales since 1929. From practically all districts in the Japanese beetle regulated area come reports of increased sales and complete sell-outs. Potted and tubbed nursery stock for Christmas trees continued to increase in popularity this year. Sales of Norway spruce in tubs showed an estimated 500-percent increase in the Baltimore district. One of the largest greenhouse men in the Philadelphia suburban district stated that the Christmas sales were the best since 1929. Plants shipped from this establishment to points outside the regulated zone during December showed an increase of 5,400 over last year. One large truck load of plants went to North Carolina, and special trains were placed on the nursery siding to handle express shipments on both December 15 and 16. Continuation of mild weather permitted maximum movement of stock. In fact, one New Jersey nursery started its regular "spring" nursery shipping season and moved considerable stock to southern points. Rose plants that ordinarily would not move until spring were shipped from Philadelphia. Shippers of perennial stock have been especially benefited. An upward turn in the wholesale potted-plant and flower business was also noted during the month. Florists in the Hartford, Conn., district reported the largest holiday sales for many years past. One of the largest florists in the city was completely sold out 2 days before Christmas and had considerable difficulty in obtaining additional stock to fill orders. An old established greenhouse at Bristol, Conn., stated that their Christmas sales were within $80 of the largest holiday sales in their history, which extends back for 76 years.

Gift to Japan certified under Japanese beetle quarantine.--Inspectors from the Trenton, N. J., district office spent considerable time in supervising the digging from lead arsenate treated soil of 50 pin oaks, 3,000 white-flowering and 1,000 pink-flowering dogwoods, 25 weeping dogwoods, 500 magnolias, 25 sweetgum, and 25 rhododendrons for shipment from a large nursery at Princeton, N. J., to the Japanese Government. The shipment was forwarded by members of the Garden Club of America as a token of appreciation for hospitality shown the members on their visit to Japan last year. Selection, packing, and loading of this stock in a special refrigerator car occupied nearly an entire week. The roots of each plant were wrapped in burlap and moss and the 21 boxes containing the shipment were ventilated in order to keep the cargo fresh during the long voyage. The plants left Princeton on December 27 for Vancouver, where the cases will be loaded aboard the SS Hikawa Maru. Information received indicates that the stock will be distributed among the parks of Tokyo, Nagoya, Osaka, and Kyoto. This gift is also regarded as a return expression of good will for the 3,000 cherry trees sent to Washington, D. C., from Japan in 1909.

Carnation cuttings to Sweden and England.--Inspections are being made in the central Pennsylvania district of rooted carnation cuttings for shipment to a classified New York broker who, in turn, is exporting the cuttings to Sweden and Great Britain. It is reported that stock plants of the Laddie variety of pink carnation in these two countries have gradually lost their vitality, and the cuttings are being sent to assist in building up a new stock.

Novelties shipped under gypsy moth certification.--Inspections were made by the Barre, Vt., inspector of a quantity of candy containers manufactured from short lengths of 6-inch branches cut from elm, birch, cherry, poplar, ash, and willow. These 6-inch logs are cut into 3-inch lengths and used by a maple-candy manufacturer at Lyndon, Vt., for her product. The center of the block is hollowed out to form a space 4 inches in diameter and 2½ inches deep. The bark is left intact on the outside. In advertising this product, the manufacturer emphasizes the fact that when the candy is removed the container may be used as a flowerpot. Inspection was also made in the Portland, Maine, district of bundles of kindling and some ornamental white and silver fireplace logs sent by a summer-camp proprietor to his guests. The kindling consisted of finely split pitch pine about 1 foot long, neatly tied with red ribbon into bundles 5 inches in diameter.

Cut of New England Christmas trees reduced.--Fewer Christmas trees were cut in the White River Junction, Vt., district than in any season since such activity began. Approximately 28,000 Christmas trees, 250 wreaths, and 6,500 pounds of boughs were certified for shipment from this district during December. The many truck, parcel-post, and express shipments of trees and mixed greens from scattered localities necessitated considerable travel over icy roads. A similar decrease in the number of Christmas trees shipped was reported from the Keene, N. H., district. A report from Hartford, Conn., illustrates the extent to which the New England cut of Christmas trees has been reduced. Most of the firms dealing in trees in that city this year purchased their stock outside the gypsy moth regulated zone. Many carloads were received from the Provinces of Nova Scotia and Quebec. More balsam than spruce was received from these sources.

Antique houses inspected prior to removal.--In the Swift River Valley of central Massachusetts a territory 18 miles in length and several miles wide is to be flooded by the Metropolitan Water Commission. All buildings and timbers are to be removed and the land cleared. Many of the oldest of the buildings are being purchased by contractors who specialize in colonial homes. After dismantling, the houses are trucked to distant points for reassembling. Several buildings of this type were inspected at the Quabbin Reservoir by the district inspector at Westfield, Mass. Four new gypsy moth egg clusters were treated on one of the buildings prior to its removal from the restricted zone. The most satisfactory method of inspecting such buildings is to examine them before they are taken down, as any egg masses deposited on the outer surfaces of the lumber may then be easily observed.

District inspectors check truck movement of Christmas trees.--For 12 days prior to Christmas five gypsy moth inspectors whose districts are on the border of the generally infested zone made part-time checks on trucks leaving the area to determine whether any Christmas trees were being hauled from the territory from which trees are not permitted movement. Seven exit highways were covered in this manner. Most of the vehicular inspection was performed from 6 p.m. to 11 p. m., when most of the truck movement would occur. Services of these district inspectors were available for this road work, despite the large amount of extra work during the Christmas holidays because Christmas trees could not be certified for movement from their respective districts.

Enlarged inspection force examines Christmas greenery.--Twenty-three temporary inspectors were employed in the inspection and certification of Christmas trees and mixed greenery moving from the lightly infested gypsy moth area during the Christmas season. Ten extra light trucks were required to transport the inspectors between cutting lots. Sales of wreaths and decorations were reported as in excess of previous years. Shipments of decorative material under certification were much heavier than in 1935. Many tons of balsam boughs and other evergreens were inspected before they were manufactured into finished products for later certification. This greenery was shipped largely to New York, Pennsylvania, Ohio, and Oklahoma.

Infested rails inspected.--Inspection of a carload of scrap rails shipped by the Boston and Maine Railroad's yards at Billerica, Mass., to Franklin, Pa., netted 18 gypsy moth egg clusters. The rails were torn up from abandoned side tracks near Rochester, N. H.

Cumberland, Md., elm-sanitation project completed.--On December 17 a project involving the removal of dead and dying elms in the valley in the vicinity of the tree infected with Dutch elm disease at Cumberland, Md., was completed. This work was carried on in a strip about 4 miles long, stretching from the infection center to Cumberland, about 3 miles, and for a distance of 1 mile beyond the center. The sanitation crews took out approximately 14,000 dead or decadent trees. In adjacent sections where the elms were of some value, 141 trees were pruned. Sixty specimens were submitted for laboratory culture, many of which showed pronounced streaking in the wood; however, none of them have yet cultured Dutch elm disease. Many specimens have been determined as Verticillium.

Seventy-three-inch elm removed.--A difficult eradication was encountered in Rumson, Monmouth County, N. J. The lawn tree involved overhung a walk and shrubbery. It was 73 inches, diameter breast height and 108 inches in diameter at the butt. Along with many similar traditions, it is claimed that the tree is over 200 years old, and that it is of historical interest because George Washington is supposed to have eaten dinner under it during the Revolutionary War. At the first crotch the tree measured 20 feet in circumference. Conservatively estimated, there were over 2 tons of concrete in cavities, together with a whole system of drain pipes and braces. The eradication required an entire week.

Dutch elm disease eradication personnel.--W. P. A. workers engaged in elm-sanitation and chemical-treatment work at the end of the month numbered 326 in Connecticut, 4,018 in New Jersey, 1,427 in New York, and 68 in areas outside the major infected zone. There were also assigned to this project 60 regularly appointed men, 118 appointed men on W. P. A. funds, 412 C. C. C. enrollees, and 54 State-appointed and per diem men. Eleven of the appointed personnel were assigned as technicians at the Morristown, N. J., Dutch elm disease laboratory.

Scolytus survey completed.--The survey of the Ohio-West Virginia area infected with *Scolytus multistriatus* Marsh. was completed on December 11. A total of over 600 specimens of beetle galleries and trunk samples was collected for laboratory tests for *Ceratostomella ulmi*. About 400 have been cultured but no Dutch elm disease fungus has been isolated. The men engaged in this survey returned to activities in the major diseased area.

FOREST INSECT INVESTIGATIONS

Fall webworm outbreak on madrone reported.--K. A. Salman, of the Berkeley, Calif., laboratory, reports that early in August 1936, madrone trees (*Arbutus menziesii* Pursh.) scattered through the stands of the Tahoe National Forest between Marysville and Camptonville, Calif., were found to be infested by a web-forming caterpillar. The species has since been determined, by rearing, as *Hyphantria cunea* Drury. Although the insect infests a number of host plants in California, usually it is not abundant in forested areas. The only other record of collection from madrone that is in the Berkeley laboratory files is one made in 1930 by H. E. Burke near Saratoga in the Big Basin area of the Coastal Range.

Bark beetle control maintained in southern California mountain areas.--J. M. Miller, Berkeley, reports that a recent survey of the Idyllwild area in the San Jacinto Mountains indicated that western pine beetle infestation was considerably less than it has been for several years. In the entire tract of some 10,000 acres, the 1936 over-wintering infestation will probably not exceed 50 trees. The private owners in this district, however, are insistent on keeping the area as clean as possible and have made plans for treatment of all infested trees that can be located during the current winter. Under a cooperative agreement, the spotting of infested trees will be carried on by the Forest Service and cost of work will be met by the individual land owners. J. W. Bongberg, who has been on E. C. W. work under the Berkeley laboratory for the past two seasons, will be carried by the Forest Service for the entomological supervision of this project.

Alder flea beetle causes defoliation in camp grounds and resort areas.--Mr. Miller also reports that during 1934 and 1935 alders growing in the canyons of the San Bernardino and Sierra Nevada Mountains were attacked by Haltica bimarginata Say. Complaints were received by the Berkeley laboratory from summer-home owners regarding conditions and requests were made for control recommendations. Apparently few, if any, trees were killed as a result of the defoliations, but the loss of shade and presence of the larvae were quite objectionable to the public. In several resort tracts in Lytle Canyon, in the San Bernardino Forest, a large percentage of the tourists left the camp ground during the period of larval feeding. At the Arch Rock entrance to Yosemite National Park and at the Merced Big Tree Grove the alders were sprayed with an arsenical formula during the early summer of 1935. This effectively checked most of the defoliation. During the summer of 1936 the infestation of the alder flea beetle was much lighter than during the two preceding years, and very little trouble was reported.

Effect of drought on growth of black locust and survival of locust borer larvae.--R. C. Hall, of the Columbus, Ohio, laboratory, reports that during the winter of 1934-35 a drought shed approximately 1/10 acre in area, was constructed on one of the black locust plantings on a coal "spoil" bank near Hopedale, Ohio. Analysis of the data for 1936 shows a marked decrease in growth, as well as a considerable increase in locust borer survival on the drought area over that on adjacent check areas that received normal rainfall. The average diameter growth at breast height, on the artificially induced drought plot, was 0.146 inches, with a 67.0-percent survival of locust borer larvae, whereas the growth on the check area, which received normal rainfall, was 0.201 inches, with but 26.2-percent survival of larvae.

Lime sulphur as a stomach poison.--S. F. Potts, of the New Haven, Conn., laboratory, reports: "An examination of the laboratory and field toxicity tests on the spruce sawfly (Diprion polytomum Htg.) showed that this species was very easily controlled by a 3-percent mixture of lime-sulphur concentrate applied as a stomach poison. This is of interest, because lime sulphur as a contact insecticide was not effective. It has never been considered a stomach poison. Of numerous insecticides tested previously on the larch case bearer it was the only one that was effective. It is also of interest to note that lime-sulphur stimulated the needle and twig growth of larch trees, and this insecticide, as well as certain oils, stimulated the growth of new white and red spruce needles."

Elm bark beetles.--W. D. Buchanan, of the Morristown, N. J., laboratory, reports on experiments he has conducted with adults of the European elm bark beetle (Scolytus multistriatus Marsh.) and the native elm bark beetle (Hylurgopinus rufipes Eichh.). The purpose of these experiments was to determine the relative number of injuries made by the two species in small elm trees under similar controlled conditions. Part of the work was done in a greenhouse and the remainder in outdoor screened cages. Adults of S. multistriatus made an average of 114 percent more injuries per individual than did adults of H. rufipes, the term "injuries" referring to places where the adults had gone through the bark and reached the sapwood. It was found that S. multistriatus made an average of 56.75 injuries per tree, whereas

H. rufipes made an average of 29.49. In the case of *S. multistriatus* 20.31 percent of the injuries were made in the tree trunks, but *H. rufipes* made 46.69 percent of its injuries in the trunks.

Dutch elm disease vectors.--The Morristown, N. J., laboratory has a room in which species of insects known or suspected of acting as vectors of the Dutch elm disease fungus (*Ceratostomella ulmi*) are reared from elm wood. The wood is placed in metal containers and as the adult insects emerge they are attracted into glass receptacles attached to the metal containers. These adults are used in various experiments and at times it is necessary to use individuals not contaminated with the fungus. Cooperative experiments conducted by C. H. Hoffmann, of the laboratory, and C. S. Moses, of the Bureau of Plant Industry, indicate the possibilities of an adult that carries the fungus contaminating others, where such rearing methods are used. Extreme care must therefore be used when a supply of noncontaminated insects is desired. The experiments further indicate that percentages of adults carrying the fungus, based on individuals collected under such conditions, might be quite different if the adults emerged in the open under natural conditions. Messrs. Hoffman and Moses conducted their experiments with adults of the smaller European elm bark beetle (*S. multistriatus*). Beetles were contaminated by allowing them to walk over chips of elm wood bearing abundant coremia of the fungus. Twenty-five noncontaminated beetles were placed in each of four 250-cc glass flasks. One contaminated beetle was added to one flask, 2 to the second, 5 to the third, and 10 to the fourth. After the flasks had been held for 18 hours in a temperature of approximately 73° F. the beetles were removed and cultured. The fungus was obtained from all but two of the beetles. These two came from the flask in which one contaminated beetle had been placed with 25 noncontaminated ones.

GYPSY MOTH AND BROWN-TAIL MOTH CONTROL

Progress of the gypsy moth project.--The number of W. P. A. workers engaged in gypsy moth work in Maine, Vermont, Massachusetts, Connecticut, New York, New Jersey, and Pennsylvania had increased to 3,206 at the end of December. Since July 1 these men have scouted more than 1,500,000 acres, approximately one-half of the acreage being in Vermont. They also scouted over 6,500 miles of roadsides, Maine and Vermont containing more than one-half of the total mileage. They have destroyed in excess of 975,000 egg clusters, nearly two-thirds of them in Massachusetts. More than 4-1/4 million trees in open country were examined and approximately 6,000 acres of woodland were thinned. In addition, nearly 140,000 feet of wire fence that was used to enclose sprayed areas adjacent to pastures has been removed and placed in the storehouse in Greenfield, Mass., as any danger of poisoning cattle that might stray from their pastures is now past.

Clean-up work progressing at large colony in Shawangunk, N. Y.--Federal W. P. A. workers under the supervision of the Conservation Department of the State of New York, in cooperation with the Federal Gypsy Moth Office, located and destroyed more than 18,500 egg clusters by the end of December.

Infestation in barrier zone in process of elimination.--Intensive scouting and clean-up work is continuing. More than 4,000 egg clusters had been creosoted up to the end of December at an infestation in the township of Putnam Valley, Putnam County, N. Y. The outside limits of this infestation, which is in the south-central part of Putnam County in the barrier zone, have not yet been determined, but most of the infestation so far discovered is confined to wooded areas composed chiefly of oak.

No gypsy moth infestations found in New Jersey.--Intensive scouting was continued in the vicinity of the assembling cage that recovered a male gypsy moth during the summer in Mendham Township, Morris County, N. J., by experienced W. P. A. workers under the direction of a State employee. The same type of work was also being carried on in Randolph Township in Morris County, Caldwell Township in Essex County, Bernards Township in Somerset County, and Fanwood and New Providence Townships in Union County. No infestations have been found in any of the localities as a result of this work.

New infestation found outside of quarantine line in Pennsylvania.--On December 18 a gypsy moth infestation was located in Dyberry Township, Wayne County, Pa., a short distance outside the present quarantine line and in the northeastern part of the infested territory. The infestation is located on the southwestern slope of a ridge, in a woodland area approximately 500 feet from the nearest woodedge and 1,200 feet from the nearest highway. The woodland is chiefly second growth, the largest trees being about 18 inches in diameter measured breast-high, and consists of beech, maple, ash, black birch, wild black cherry, basswood, and elm, with a scattering of poplar. The predominating species is beech. While the limits of infestation have not yet been definitely determined, it apparently does not cover a large area and its complete eradication does not appear to present any serious difficulties. Assembling cages were placed approximately 1/2 mile apart throughout the entire township during the summer of 1934. Seven of these cages were located within 1 mile of this colony, one of them being less than 1/2 mile distant, but no gypsy moths were captured. For this reason no scouting work was carried on in the township during the fiscal years 1935 and 1936. It was decided to scout the township this year as a precautionary measure, after the discovery of an infestation in the northeastern corner of Carbondale Township, located within the quarantined area in Lackawanna County, and only a few miles distant from Dyberry. This resulted in the discovery of the Dyberry infestation.

Alert inspectors prevent reinfestation of area where eradication campaign is in progress.--In one case an infestation of approximately 300 egg clusters was found in the borough of Breslau, situated in the northwestern portion of Hanover Township, Luzerne County, Pa., on property that had recently been vacated. Arrangements were made to inspect the foundation and cellar of the vacated building, and several egg clusters were located and destroyed. The people who had moved were traced to the Firwood Section of Wilkes-Barre, where an intensive extermination campaign had been waged. Inspectors were sent to the Wilkes-Barre address to inspect all material from the Breslau residence that might be infested by this insect and they found and destroyed 14 new egg clusters on lumber that had been transported. In a second case inspectors found and destroyed a total of 34 egg clusters on a lot of second-hand lumber in Plains Township, Luzerne County, while examining it prior to shipment to other localities. Unconscious reinfestation of areas where the insect has been eliminated by people who are unaware of the quarantine regulations, as well as deliberate violations of those provisions, can only be prevented by constant alertness on the part of the inspectors responsible for the enforcement of the quarantine.

Progress of C. C. C. gypsy moth work.--From July 1, 1936, to January 2, 1937, the C. C. C. camp enrollees engaged in gypsy moth work in towns east of the barrier zone in Massachusetts, Connecticut, Vermont, and New Hampshire have scouted more than 500,000 acres and over 1,300 miles of roadside; have examined nearly 557,000 isolated trees and slightly more than 37,500 yards of stone walls; have thinned and cleaned almost 3,000 acres of woodland; have destroyed approximately 1,800 isolated trees; and have treated over 2,850,000 egg clusters.

Connecticut C. C. C. camps receive gypsy moth literature.--A considerable amount of gypsy moth literature, colored cards, and posters was distributed to all of the C. C. C. camps in Connecticut, in order to increase the men's knowledge of their work and to stimulate their interest.

Arrangements made for important work in Vermont.--It had been intended to work in this locality last year, but the plan was necessarily abandoned because of a decrease in enrollment. Work in this section is especially important, as Plymouth is located in the general direction of spread of the insect from the Connecticut River towns through a break in the mountains in a northwesterly direction, up a valley, toward the barrier zone.

Type mapping completed on one block in Massachusetts.--The type mapping of a large tract of land in the northeastern section of Greenfield and extending into the southern part of Bernardston, Mass., by the E. C. W. forester cooperating with this office, with the assistance of a small crew of men from the Greenfield C. C. C. camp, is progressing satisfactorily. Base (or control) lines have been established, cruise lines have been run, and the type mapping has been completed in one block of approximately 273 acres. It is planned to type map other adjacent blocks, bringing the total acreage mapped up to slightly more than 1,300 acres. This area will be cleaned and thinned, and will serve as a demonstration of accepted silvicultural procedure as applied specifically to gypsy moth control.

Progress of brown-tail moth work.--The number of W. P. A. workers employed on the brown-tail moth project had increased to 1,330 at the end of December. The crews were widely distributed over practically all of the area of known infestation in Maine, New Hampshire, Vermont, and Massachusetts, and were engaged mainly in scouting for infestations and in cutting and destroying all winter webs found, although some of the crews in New Hampshire continued the elimination of favored food plants during the first part of the month. Since July 1 the crews have examined more than 5,860,000 trees, have cut over 109,000 trees, have scouted approximately 12,000 miles of road, and have cut and destroyed nearly 800,000 winter webs. No sign of an infestation has been discovered in Vermont.

Infestation generally lighter than last year.--Although a few localities have been found to be quite heavily infested, reports from the field indicate that over much of the infested territory the infestation is far lighter than it was at this time last year. This can probably be largely attributed to the intensive clean-up campaign waged over the infested region during the previous season.

PLANT DISEASE CONTROL

Winter rust studies in connection with barberry eradication.--A close watch has been kept on the development of stem rust in certain areas of Texas during the fall and early winter. Wallace Butler reports exposing vaselined slides during November and December as a means of accumulating further data relative to the source of inoculum for the rust that ordinarily develops in Texas during the late fall months. It is expected that the information obtained from these slides will be of some value in determining whether viable rust spores are being blown from Mexico at this time of the year. Certain species of barberries that have proved highly resistant or immune to stem rust in the outdoor test garden at Bell, Md., are being tested this winter under controlled conditions in the greenhouse at Saint Paul. This work, which is conducted by R. U. Cotter, serves as a further check on doubtful species and the progeny from those that have proved highly resistant or immune when tested under the more natural outdoor conditions.

Weather conditions favored field activities in barberry eradication in November and December.--An average of more than 3,800 security wage earners were employed on barberry eradication during November and about 2,600 to 2,800 during December. With few exceptions, field supervisors reported very favorable working conditions. In many States timbered areas, made practicably impassable by heavy underbrush during the summer months, have been worked with much greater efficiency during the early part of the winter. The same is true of some swamp areas in certain parts of Michigan and Indiana.

Chicago survey.--A survey of Cook County, Ill., for barberry bushes has been completed. Robert W. Bills, in charge of barberry eradication in Illinois, reports that during 1936 approximately 6,000 barberry bushes were destroyed on 458 properties in Cook County. A complete survey of the city of Chicago has now been made for the first time since the barberry-eradication program was undertaken. During the year nearly 7,000 square miles of area in Illinois has been intensively surveyed. This includes much heavily wooded and cutover land along rivers in the north-central part of the State.

Talk on barberry eradication at Morris Arboretum.--On January 9, L. M. Ames gave a talk entitled, "Barberries, Friends and Enemies", before a group at the Morris Arboretum, Philadelphia, Pa. Dr. Ames, in addition to summarizing recent progress in barberry eradication in Pennsylvania, briefly reviewed the barberry problem in the United States from the taxonomic point of view.

Spread of white pine blister rust in the sugar pine region in 1936.--During 1936 new blister rust infections were found in six counties in Oregon--Coos, Jefferson, Lane, Clackamas, Hood River, Curry, and Josephine. All of these counties had been reported as having blister rust infections prior to this year, with the exception of Josephine County, where infection was found for the first time on October 15, 1936. The hosts infected were *Pinus lambertiana*, *P. monticola*, *P. albicaulis*, *Ribes cruentum*, *R. bracteosum*, and *R. glutinosum*. In California, where blister rust was reported for the first time in 1936, infections were found in two counties--Del Norte, where the rust was found at two locations, *P. lambertiana* and *R. bracteosum* being the infected hosts, and Siskiyou County, where the rust was found at three locations on *P. lambertiana*, *R. bracteosum*, *R. sanguineum*, *R. lobbii*, and *R. cruentum*. In view of the present known distribution of the rust in this region, and its propensity for long-distance spread, it is essential that the blister rust control program be carried on as rapidly and energetically as possible to prevent damage in commercial sugar pine stands.

Results of pine- and control-area mapping under W. P. A. program in Northeastern States.--Since the first of October 1936, approximately 330 W. P. A. relief laborers have been employed on blister rust control activities in all of the Northeastern States except New Jersey. Most of these employees have been assigned to preeradication survey work, which consists of the preparation of maps showing the location of white pine areas and the boundaries of blister rust control protective zones. In addition to this survey work, a few W. P. A. laborers have been used in New York on blister rust canker elimination work in publicly owned white pine plantations. During the period October 1 to November 30, 1936, a total of 503,129 acres have been mapped under this W. P. A. project. In addition, 649,378 acres were examined and eliminated from control work, owing to lack of sufficient pine to justify the cost of *Ribes* eradication. A total of 234 miles of control area boundary lines were also painted in the field. This mapping work required 7,939 man-days of labor and gave much needed employment to men obtained from relief rolls.

Another county from Wisconsin infected with blister rust.--T. F. Kouba, in charge of blister rust control work in Wisconsin, reports another newly infected county from his State, namely, Fond du Lac County, where blister rust was discovered on 17 *Ribes nigrum* bushes on November 17, 1936. This makes 3 counties in Wisconsin in which blister rust was reported for the first time in 1936 on *Ribes*, and 10 counties in which the rust was reported for the first time on white pine.

COTTON INSECT INVESTIGATIONS

Sulphur and arsenical mixtures for the cotton flea hopper and other insects.--During the last few years considerable interest has been manifested in the use of mixtures of sulphur and arsenicals for the control of the cotton flea hopper and other cotton insects. Last season several insecticide dealors sold considerable quantities of mixtures of sulphur and paris green. The tests with the mixtures of sulphur and arsenicals indicate that they kill a much higher percentage of adults, give quicker control, require fewer applications for the cotton flea hopper, and control the boll weevil and leafworm at the same time. K. P. Ewing and R. L. McGarr conducted a series of cage tests and four plot and four large-scale field tests at Port Lavaca, Tex., against the flea hopper, and a series of plot tests at Edna, Tex., against the boll weevil last season with these mixtures. In the cage tests 20 percent calcium arsenate-80 percent sulphur caused 26 percent mortality of the adult flea hoppers; the 33-1/3 percent calcium arsenate-66-2/3 percent sulphur, 24 percent; 50 percent calcium arsenate-50 percent sulphur, 23 percent; 10 percent paris green-90 percent sulphur, 56 percent; sulphur, 15 percent. The flea hopper infestation was much lower than it had been during the preceding 3 years and the unusually heavy rains (26 inches during May, June, and July) were unfavorable for experimental work and seriously affected the yields and gains secured from the control measures. The average increase in yield from the four 1-acre plots was 127 pounds of seed cotton per acre from the 10 percent paris green-90 percent sulphur mixture, 94 pounds from the 20 percent calcium arsenate-80 percent sulphur, and 88 pounds from the sulphur. The average yield of the checks was 455 pounds per acre. An average of four dust applications of about 12½ pounds each per acre were applied. In the four large-scale experiments dust was applied with traction or tractor machines to 7-acre fields of cotton. The average gain from the 10 percent paris green-90 percent sulphur mixture was 130 pounds per acre; from the 20 percent calcium arsenate-80 percent sulphur, 130 pounds; and from the sulphur, 134 pounds per acre. Field-infestation and bloom-count records showed there was very little difference in the control from the paris green-sulphur and calcium arsenate-sulphur mixtures and that both gave better control than did the sulphur. In the boll weevil tests at Edna, Tex., where the infestation was rather heavy, the heavy rains and spotted bollworm infestation late in the season also interfered with the experiments. In this series different percentages of calcium arsenate and sulphur were compared with the 10 percent paris green-90 percent sulphur and calcium arsenate. The results were as follows:

Insecticide	Plot no.	Average gain of seed cotton per acre
		Pounds
20% calcium arsenate-80% sulphur	6	167
33-1/3% calcium arsenate-66-2/3% sulphur	3	281
50% calcium arsenate-50% sulphur	5	200
Calcium arsenate	8	174
10% paris green-90% sulphur	11	82

The mixtures were used at the rate of 10 to 12 pounds per acre and calcium arsenate at 5 to 6 pounds per acre. It is believed that a late bollworm infestation in the 50 percent calcium arsenate-50 percent sulphur plots caused them to produce less than the 33-1/3% calcium arsenate-66-2/3 percent sulphur plots. In cage tests at Tallulah, La., G. L. Smith and A. L. Scales obtained the following percentages of control.

Insecticide	Control of Boll weevil	Control of Leafworm
	Percent	Percent
20% calcium arsenate-80% sulphur----------	44	71
33-1/3% calcium arsenate-66-2/3% sulphur-	56	83
50% calcium arsenate-50% sulphur----------	53	84
10% paris green-90% sulphur---------------	46	78
Calcium arsenate--------------------------	79	90

In Latin-square tests against a light infestation of boll weevils at Tallulah, La., R. C. Gaines found the increased yield for calcium arsenate over 50 percent calcium arsenate-50 percent sulphur insignificant, but the gains from both over the checks were significant. Plot tests were conducted by M. T. Young and G. L. Garrison at Tallulah with the mixtures in comparison to calcium arsenate against the boll weevil. The weevil infestation was extremely light all season and the gains from calcium arsenate were only about one-third of what they usually are. In five tests the 20 percent calcium arsenate-80 percent sulphur mixture gave an average increase in yield of 170 pounds of seed cotton per acre and the comparable calcium arsenate plots 160 pounds. The checks produced 1,882 pounds per acre. The infestation records, however, showed the calcium arsenate gave much better control. In seven tests the mixture of 33-1/3 percent calcium arsenate-66-2/3 percent sulphur gave an increase of 173 pounds and the calcium arsenate 105 pounds of seed cotton per acre. The checks averaged 2,293 pounds per acre. The two calcium arsenate-sulphur mixtures were applied at the rate of 15 to 18 pounds per acre and the calcium arsenate at 4 to 6 pounds per acre. In three tests the 10 percent paris green-90 percent calcium arsenate gave an increase of 10 pounds, the comparable 33-1/3 percent calcium arsenate-66-2/3 percent sulphur 252 pounds, and the calcium arsenate 204 pounds of seed cotton per acre. The checks produced 2,441 pounds. The square-infestation counts showed slightly better weevil control from the 10 percent paris green-90 percent calcium arsenate mixture than with calcium arsenate or the calcium arsenate-sulphur mixture. The yield records are not in line with the infestation records and the larger yields obtained were probably due to the control of mirids by the calcium arsenate-sulphur mixtures. In a few tests against the bollworm at College Station, Tex., the 10 percent paris green-90 percent sulphur mixture gave about the same increase as calcium arsenate and was more effective than the calcium arsenate-sulphur mixtures. All of the mixtures for flea hopper and boll weevil control held the leaf worm in check, although those with more arsenic gave quicker control. Although the results are not conclusive, they indicate that mixtures of calcium arsenate and sulphur are more effective against the boll weevil than paris green-sulphur mixtures and will give satisfactory control of the flea hopper, the boll weevil, and the leaf worm.

PINK BOLLWORM AND THURBERIA WEEVIL CONTROL

Gin-trash inspection.--Gin-trash inspections in the 1936 cotton crop were completed at the end of the second week in December. In the Salt River Valley of Arizona two machines were operated during this period with negative results. Trash from all gins in the valley was inspected and, in view of the lateness of the season, it is believed that a very good job was done.

Field clean-up in the Big Bend of Texas.--The clean-up of cotton fields in the Big Bend area of Texas was discontinued on December 19. In the beginning it was known that funds were not sufficient to clean the entire area, and consequently an effort was made to clean the most heavily infested fields. In practically every case this was accomplished. A total of 1,228 acres was cleaned. In the Castolon district, in Brewster County, one farm, consisting of about 100 acres, was pastured with some 600 head of cattle. After the cattle had been in the fields for several weeks an investigation was made and it was found that the fields were surprisingly clean. Practically no material was left and very little had been tramped into the ground. Last fall work was begun to develop a machine to burn the material in cotton fields, instead of regular clean-up with laborers. The experiments have now reached a point where we can say positively that the principle is a success. It has been definitely established that there is enough fuel in the cotton field to burn all of the debris. The experiments are still going forward, and there is every indication that these machines can be used in future clean-ups to better advantage than the old method.

Wild cotton eradication.--The eradication of wild cotton in southern Florida made very good progress and by the end of December all of the cotton areas in Pinellas, Hillsborough, Manatee, and Sarasota Counties had been recleaned. A few keys remained to be cleaned to complete Lee County. In Charlotte County and in a considerable portion of Collier County all of the areas accessible by car had been recleaned. All of the above counties are on the west coast. At each recleaning the number of plants is found to be greatly reduced and in a number of locations none was found. Indications are that eradication will be completed in these west coast counties several years in advance of other areas, because there was considerably less cotton to begin with and because more man-days have been devoted to this section. This was considered advisable because the section is much closer to domestic cotton, and infestation was originally found in the vicinity of Bradenton. Several of the mainland keys have been recleaned and satisfactory progress made on the others. The situation on Boca Grande Key is of particular interest. Last season around 1,000,000 plants were removed during the recleaning, whereas at this time slightly over 3,000 plants were removed. At this time some bolls were present on a few of the sprout plants and seedlings which had made unusual growth, but none of these had shattered, and during the recleaning none of the cotton was allowed to drop to the ground. Some 400 bolls were examined and 4 pink bollworm larvae were found. The original infestation on this key was about 35 percent. A camp was reestablished at Cape Sable and recleaning begun on December 7. At the close of the month a considerable area had been recleaned. During the recleaning when a number of bolls are encountered they are placed in preservative for later inspection. When only a few bolls are present they are immediately inspected. Other than the findings on Boca Grande Key the results have been negative.

Thurberia-plant eradication.--The eradication of Thurberia plants in the Santa Catalina Mountains of southern Arizona has progressed satisfactorily considering weather conditions. Early in the month it was realized that work could not be continued much longer using Camp Lawton as a base, because of the high elevation. A new site was therefore found in Sabino Canyon at a much lower elevation. By the middle of the month all of the equipment had been transferred to this new site, named Camp Sidney Smith. During the month 3,030 acres were gone over and 40,080 Thurberia plants destroyed. These plants occurred at elevations up to 5,400 feet. The highest elevation at which plants have been found thus far is 5,600 feet.

Road-station inspection.--During December 10 interceptions made at the Marfa, Tex., road station were found to be infested with the pink bollworm. The infested material consisted of small lots of seed cotton, from which 53 living and 8 dead larvae of the pink bollworm were taken. One of the interceptions was of particular interest. The owner of the car stated that he had moved to the Big Bend area to farm, but after remaining there a few weeks decided he did not like it and was returning to Coahoma, Tex. He had 3 pick sacks in his car in which were found 36 locks of seed cotton. The seed cotton contained 7 living and 2 dead pink bollworm larvae. He first claimed the material was from his first location, which is outside the regulated area, but later admitted that he had been picking cotton in the Big Bend. Heretofore the road station has been discontinued around the first of January, as field clean-up in the Big Bend was usually completed by that date. Due to the fact that all of the fields had not been cleaned this season, and a considerable number of infested interceptions are being made, it is considered advisable to keep the road station in operation for the time being.

TRUCK CROP AND GARDEN INSECT INVESTIGATIONS

Solutions containing free nicotine promising against mushroom flies.--Tests made by A. C. Davis against various species of mushroom flies and other pests in the mushroom houses at the Beltsville, Md., laboratory demonstrated that free nicotine (40 percent) in water at dilutions of 1-100 and 1-200 (containing 0.4 and 0.2 percent free nicotine, respectively), applied as a drench to the mushroom beds at the rate of 100 cc per square foot promised control of the flies and other pests and caused a marked increase in the production of mushrooms on the beds receiving this treatment. Beds treated at 4-day intervals, with a total of five or six treatments, yielded approximately one-third more mushrooms than those treated at 8-day intervals, and gave about twice the yield of the untreated beds. Nicotine preparations containing from 95 to 98 percent nicotine, when diluted at the rate of 10 to 12 ounces per 100 gallons of water (0.5 to 0.6 percent nicotine) have long been used as a drench for the control of mushroom flies in England. In this series of experiments, however, dilutions of 40 percent nicotine 1-400 (containing 0.1 percent nicotine) or greater, gave little or no increase in yield. Samples of mushrooms treated with the free nicotine solutions were analyzed by the Insecticide Division of this Bureau. The results of such analyses show that the highest nicotine content of any sample was 29 parts per million by weight, a quantity not believed to be harmful to the consumer.

Relative effectiveness of cube dusts containing various dilutions of rotenone against tobacco flea beetle.--In experiments designed to show the relative toxicity of cube dust mixtures containing 1.5, 1.0, and 0.5 percent rotenone, respectively, against the tobacco flea beetle (*Epitrix parvula* Fab.) on shade-grown tobacco in Florida, F. S. Chamberlin, of the Quincy, Fla., laboratory, reports that the dust mixtures containing 1.0 and 1.5 percent rotenone, respectively, were much more toxic and gave a better control of the flea beetles than the cube dust mixture containing 0.5 percent rotenone. These conclusions were reached as a result of a detailed study of the harvested product, in which it was shown that the percentages of injured leaves, together with the percentages of the commercial gradings, served as a satisfactory method for obtaining a relative comparison of the effect of the different dilutions used. Incidentally, these studies demonstrated that a flea beetle infestation of only moderate intensity may cause a loss in cigar-wrapper tobacco which reaches $475 per acre, if insecticidal control measures are not adopted.

Comparative efficiency of different spreading, wetting, and sticking agents used with rotenone compounds against pea aphid.--In the course of recent tests performed in the greenhouse by T. E. Bronson, of the Madison, Wis., laboratory, which involved the use of different spreading, wetting, and sticking agents with the derris sprays ordinarily employed for combating the pea aphid (*Illinoia pisi* Kalt.), it was indicated that a commercially prepared product containing a sodium oleyl alcohol sulphate was the most effective agent used with derris, and that resins or other adhesive agents were not effective in protecting the active ingredients of derris from loss either through decomposition or by the effect of washing with a water spray. In the course of these experiments the pea plants were first sprayed with a derris solution containing one of the spreading, wetting, or sticking agents. Some of these treated plants were infested by hand methods 24 hours after they had been sprayed and others were washed twice with water and infested 5 days after spraying. The results of these tests show that there was some residual effect of derris in all of the tests in which plants were infested with the pea aphid 24 hours after spraying, but it was indicated that probably no residual effect of derris was apparent in the tests where plants were washed twice after spraying and then infested with the pea aphid.

Late planting aids wireworm control in potatoes.--K. E. Gibson, of the Walla Walla, Wash., laboratory, reports that as a result of experiments performed during 1936, it was shown that considerable benefit could be derived by the late planting of potatoes in fields infested with the sugar beet wireworm (*Limonius californicus* Mann.) and the Pacific coast wireworm (*Limonius canus* Lec.). In experimental plots planted on April 7 and harvested during the period from August 10 to 17, an average of 57 percent of the potatoes was injured by wireworms, whereas in the experimental plots planted on June 23 and harvested early in November, an average of approximately 44 percent of the tubers showed wireworm injury. Actually the difference in the relative wireworm injury suffered by early and late plantings of potatoes was less in 1936 than during previous years, because seasonal conditions in 1936 were such that the wireworms did not begin their seasonal migration downward until a later date than normal. The results of time-of-planting tests to escape maximum wireworm damage have demonstrated that the late-planted potatoes suffer significantly less wireworm injury than do early planted potatoes, even though late planting usually gives reduced yield.

Tomato pinworm larvae pupate at or near soil surface.--J. C. Elmore, of the Alhambra, Calif., laboratory, has determined that a very high percentage of the larvae of the tomato pinworm (*Gnorimoschema lycopersicella* Busck) pupate at or just below the soil surface. Field examinations indicated that approximately 80 percent of the larvae pupated in the top half-inch layer of soil and that approximately 98 percent of them pupated in the first inch. These field observations were supplemented by laboratory experiments simulating field conditions in which it was shown that 99.5 percent of the *G. lycopersicella* larvae formed pupal cells in the top quarter-inch layer of soil and that the remainder were present in the quarter-inch layer of soil below that depth. It is apparent that the tendency of the tomato pinworm larvae to pupate very close to the soil surface may make it possible to ascertain some measure of control of these pests through the medium of cultural practices directed toward the disturbance or destruction of the pupal cells during critical periods.

Beet leafhopper populations increase in San Joaquin Valley.--G. T. York, of the Modesto, Calif., laboratory, reports that population surveys of the beet leafhopper (*Eutettix tenellus* Bak.) made in the San Joaquin Valley of California during the fall of 1936 have indicated that in nine districts, totaling about 65,000 acres, there were approximately 25,000,000 *E. tenellus*. This is about three times the population found in the same districts in 1935 and approximately one-fifth of that found in the same districts in 1934.

INSECTS AFFECTING MAN AND ANIMALS

Ants appear to be efficient destroyers of screwworm larvae.--Observations made by A. W. Lindquist, of the Uvalde, Tex., laboratory, indicate that various species of ants are of great importance as destroyers of large larvae of *Cochliomyia americana* Cushing and Patton in animals that die of screwworm infestations. Emergence records kept on seven carcasses harboring approximately 9,400 third-instar larvae show that the ants had killed about 92 percent of them.

New locality records for Phlebotomus diabolicus Hall.--Mr. Lindquist reports that *P. diabolicus*, the biting psychodid, has been more abundant and more troublesome than at any time since 1931. The earliest record in 1936 was April 29 and the latest November 20. The height of incidence occurred from September 15 to November 2. These pests were very annoying during this period and many people reported them. About 120 specimens were collected (mostly females) in October in one residence at Uvalde, Tex. A very interesting note was made on June 13, when one *Phlebotomus* was caught and others observed by a campfire on the banks of the Nueces River, 2 miles from any human habitation, in the vicinity of Camp Wood, Tex. This note points toward a wild animal host for this pest as well as giving a new locality record. Another important record was made by Claudelle Lewis, of the Screwworm Control

Division, San Antonio, Tex., when she determined the presence of Phlebotomus during the summer and fall. This constitutes a new locality record and extends the distribution of the pest.

Winter activity of primary screwworm fly.--D. C. Parman, of the Uvalde, Tex., laboratory, reporting on the number of screwworm infestations in the vicinity of Uvalde for the period January 4-9 inclusive, states: "During this period practically all ranches have had screwworm cases, there being a considerable increase during this week. Ranchmen reported from 3 to 40 cases. There have been estimated from 300 to 400 cases during the past 10 days in this vicinity. All of the larvae collected from these cases were C. americana." For Valdosta, Ga., E. W. Laake reports as follows: "Heavy oviposition on December 26 and 27 of C. americana in hibernation cages indicates that this species will overwinter at Valdosta this winter. This generation, which should emerge as adults the latter part of February or early in March, will have a very good chance at that time, under normal local climatic conditions, to continue reproduction into the next summer." At Tempe, Ariz., C. C. Deonier reports that the status-trapping work in Arizona has indicated that C. americana was as abundant along the escarpment between Phoenix and Prescott during the fall as at Uvalde, Tex. The work shows a considerable decrease in C. americana at Tempe during the fall and early winter and no increase during the latter half of December, as there was at Uvalde. The decrease continued into the latter half of December, only two C. americana being taken in the total fly catch, and three in the lower part of Black Canyon. Besides these no C. americana, and very few C. macellaria Fab., were taken during the latter half of the month. The total catch in all of the traps continued to decrease during the latter half of the month.

Salt water appears necessary to induce oviposition of sand flies.--J. B. Hull, of the Savannah, Ga., laboratory, reports the following observations on experiments to secure oviposition of sand flies in the laboratory: "Numerous sand flies were collected on 2 days in October by sweeping. These were placed in fruit jars, brought to the laboratory, and transferred to glass lamp chimneys. One end of each chimney was covered with cheesecloth and the other placed over blotting paper moistened with distilled water. These sand flies were given three meals of human blood, but failed to deposit any eggs. Sand flies were collected on December 6 and 7 and the same procedure was followed except that the blotting paper was moistened with salt water collected from the marsh. From this collection 391 eggs were deposited. Apparently the salt water stimulates oviposition.".

Sand fly research resumed at Fort Pierce, Fla.--The Division of Insects Affecting Man and Animals has recently resumed research work on the sand fly problem along the east coast of Florida. The laboratory is located in the city hall at Fort Pierce, with S. E. Shields in charge.

Moderately low temperatures increase longevity of tick parasite.--C. N. Smith and Helen Louise Trembley, working on the biology of Hunterellus hookeri How., a hymenopterous parasite of the American dog tick and the brown dog tick, have found that the longevity of the adults at temperatures of 40° F. is 5 days and at 55° to 65° it is 2 weeks. The normal longevity at approximately 80° averages from 2 to 3 days.

FOREIGN PLANT QUARANTINES

Entomological interceptions of interest.--Fourteen living larvae of the Mexican fruit fly (Anastrepha ludens Loew.) were intercepted at El Paso, Tex., on September 21, 1936, in a chêrimoya (Annona cherimola) fruit in baggage from Mexico. A living larva of the West Indian fruit fly (Anastrepha acidusa Walk.) arrived at Mobile, Ala., on August 7, 1936, in a mango fruit in ship's stores from Puerto Rico. A living adult of the bruchid Acanthoscelides xanthopus (Suffr.) was taken at Washington, D. C., on October 16, 1936, in seed of Cassia didymobotrya in the mail from Cuba. Living specimens of the coccid Asterolecanium stentae Brain were intercepted at San Francisco on September 16, 1936, on Caralluma schweinfurthii and Huernia campanulata in the mail from the Union of South Africa. Two living specimens of the chermid Rhinocola ericae Curt. were found at Philadelphia on September 10, 1936, on heather in the mail from Scotland. Living adults of the hairy-vetch bruchid (Bruchus brachialis Fahr.) arrived at Baltimore, Md., on September 18, 1936, with vetch seed in cargo from Germany. A living adult of the elaterid Pheletes quercus Oliv. was taken at Norfolk, Va., on August 24, 1936, with a hyacinth bulb in cargo from the Netherlands. The coccids Phenacaspis samoana Doane and Ferris and Pseudococcus cocotis (Mask.) were intercepted at Honolulu, Hawaii, on August 4, 1936, on coconut-leaf baskets in cargo from American Samoa. A living adult of the weevil Sitophilus mexicanus Champ. was taken at Laredo, Tex., on July 13, 1936, in a green bamboo pole in baggage from Mexico. Aleurolobus marlatti (Q.) arrived in baggage as follows: At New York on November 14, 1935, on citrus leaves from Italy; at Seattle, Wash., on November 30, 1935, on a tangerine leaf from Japan; at Seattle on December 16, 1935, on an orange leaf from Japan; and at El Paso, Tex., on March 25, 1936, on orange leaves from Mexico. These represent the first records in our files of this whitefly being intercepted. Two living larvae of the large cabbage butterfly (Pieris brassicae L.) were taken at New York on August 6, 1936, on green leaves of broccoli (Brassica oleracea botrytis) in ship's stores from Italy.

An individual convinced.--On December 17, 1936, the British SS Clan Graham entered the port of Norfolk, Va., from London, England. In making the usual inspection of quarters, the inspector was accompanied by the ship's fourth officer. This officer's seeming amusement of each room inspection finally got under the inspector's skin, so the inspection was temporarily halted for explanations. The inspection may have been amusing to the Britisher, but was serious to the inspector and the Britisher was so informed. Apparently the British officer had made few trips to the United States, and had never accompanied an inspector on his rounds. After the purpose of the work had been explained, he vouchsafed that his ignorance of what we were doing permitted him to see only the funny side, but that henceforth, having been enlightened, he would be in a position to see the serious side. The inspection was continued with splendid cooperation on the fourth officer's part.

Pathological interceptions of interest.--Our first interceptions of Ascochyta lycopersici Brun. were made at New York on December 3 and December 17 on eggplant from Italy and on tomato from French Morocco. Ascochyta pisi Lib. was intercepted from Poland for the first time on December 2 at New York, in hairy vetch seed in cargo. Our first interception of an *Ascochyta* on parsley was an undetermined species in parsley from Germany at New York on December 4. *Botrytis elliptica* (Berk.) Cke., first interception, was taken at Sumas, Wash., on December 7, in a shipment of lily bulbs from Japan. *Cercospora* sp., no species found listed for the host, was found in *Cordia boissieri* at Laredo in baggage from Mexico. *Cladosporium carpophilum* Thuem. was intercepted from South Africa for the first time on December 8 on apricots at New York. *Helminthosporium allii* Campanile was intercepted on garlic from Cuba (new country) December 1 at Mobile. A pod rot of peppers from Cuba, intercepted at New York on December 13, seems to be the same as one described by Weber (Fla. Bul. 244:42), the organism being named as *Helminthosporium curvulum* Sacc. *Phyllosticta grandimaculans* Bub. and Krieg. was intercepted (first interception) at New York on December 5 on strawberry plants from Norway, in baggage. *Phyllosticta japonica* Miy. was intercepted for the first time on December 14 at Seattle in paddy rice from China in the mails. *P. laeliae* Keissler (first interception) was found on *Laelia anceps* from Mexico on November 20 at San Francisco. A severe rot of pears and apples was found in fruits from Germany taken at New York on October 23 and November 20, and of apples from Poland on December 17, all in baggage. The pathogen in each case appears to be *Sclerotinia laxa* (Ehrenb.) Aderh. and Ruhl., which is known as a serious rot of stone fruits in Europe. *Sclerotium oryzae* Catt. was found on rice straw from Greece on December 3, and from Jamaica on December 16 (additional countries), at New York. *Septoria lactucae* Pass, leaf spot of lettuce, was intercepted from Trinidad for the first time on December 3 at New York.

DOMESTIC PLANT QUARANTINES

Transit inspectors to certify materials under quarantine.--The practice of turning back shipments of restricted materials found on inspection at railway terminals to be moving in violation of domestic Federal plant quarantines is being modified. Transit inspectors are now authorized to examine certain types of such materials as may be readily and adequately inspected at a railway terminal and, if found to be free from the pest involved, to certify the shipment and allow it to proceed to the consignee. Interception records show that many persons making shipments are unaware of the existence of Federal quarantines, and it is felt that inspection in transit is a service which can be given without weakening in any way the effectiveness of the restrictions intended to prevent the spread of the pests. Consignors will be notified as heretofore of violations committed and any repetition of failure to obtain the required inspection at origin will be met by having the shipment returned.

Transit inspection at Atlanta.--In order to inspect shipments moving at this period of the year from nursery centers to points in the southern States, transit inspection is being conducted at Atlanta, the inspector formerly at Kansas City having been transferred to the southern post.

Citrus canker emergency project yields results.--A summing up of the progress of citrus canker inspection and eradication during the past 2 years, as compared with the work of the previous 13 years, indicates that the results accomplished with emergency relief funds have marked the difference between early eradication of the canker and a prolonged program under limited regular appropriations which were not only inadequate to complete eradication but not sufficient to hold the disease in abeyance. In Texas 35 infected properties were located during the period 1921-34. In 1935-36, 47 infected properties were located in Texas, and 9 in Louisiana. Thorough and complete inspection has been made of the entire citrus-producing areas of Texas and Louisiana, and a large part of the Gulf coast areas of Mississippi and Alabama, covering a total of 69 counties and parishes. A house-to-house inspection of every property in the four infected counties in Texas resulted in finding citrus plants on 2,283 properties. These trees have been destroyed on all but 43 of the properties. Eradication crews employed under emergency relief funds have removed all citrus plants (nearly 11 million) from over 98 percent of the citrus-growing properties in the known infected areas of Louisiana and Texas, thus removing the source of infection from which the disease might eventually reach the commercial areas. In order to complete the eradication of this disease it is necessary to recheck the sites from which such trees have been removed and to reinspect the remaining citrus plantings in the vicinity of old infections.

Peach mosaic inspection and eradication.--In Colorado the eradication work which has been carried on in two counties since August 1935 (suspended only in midwinter) was closed for the season on December 15, and the field leader reports that this marks the completion of the removal of all abandoned and infected peach trees in Mesa County, an important commercial peach-producing area. Some eradication work yet remains to be done in Delta County. In California contacts have now been made with owners of all infected properties, totaling 899, of which 456 have signed releases authorizing removal of their trees. Inspections made in the field season of 1936 cooperatively with the plant-pest control officials of Arizona, California, Colorado, Iowa, Kansas, Nebraska, New Mexico, Texas, and Utah, resulted in finding the peach mosaic disease in all these States except Iowa, Kansas, and Nebraska. Nearly 48,000 mosaic-infected trees were found in 39 counties in these 6 Southwestern States. All known diseased trees have been removed from Colorado and Utah, the eradication work is under way in California and Texas, and will be extended to Arizona and New Mexico early next spring.

Phony peach disease under economic control.--During the past field season over 150 Federal and approximately 50 State inspectors were employed. Surveys for the phony peach disease were carried on in every peach-growing State east and northeast of, and including Texas and Arkansas, with the exception of Michigan, New York, and New England, and over 21,000,000 peach trees were inspected on 196,344 properties in 550 counties of 20 States. Of the 156,977 trees found diseased, 146,072 have been removed. All known diseased trees have been eradicated from eight States, namely, Arkansas, Illinois, Indiana, Louisiana, Mississippi, Missouri, North Carolina, and Pennsylvania. Of the 10,905 diseased trees remaining to be removed from Alabama, Georgia, Kentucky, South Carolina, Tennessee, and Texas, 10,422 are in Georgia, and it is believed that before the winter is over all diseased trees will be removed from all States except Georgia. As a result of these surveys the disease was found for the first time in 1 county each in Indiana and Pennsylvania, and in 52 counties in 12 of the States where the phony peach disease had previously existed. The environs of every peach-growing nursery in all the known infected States were given a very thorough inspection for the phony peach disease in the season of 1936. Of the 422 nurseries inspected, 104 were found exposed to the disease. A concerted effort by Federal and State inspectors to effect the removal of these diseased trees has been successful to the extent that only one known unprotected peach-growing nursery now remains in the infected States. Over 51,700,000 escaped and abandoned trees have been destroyed by relief workers. The project therefore has a very favorable status.

CONTROL INVESTIGATIONS

High concentration of sulphur found in blood of southern armyworm.--F. H. Babers, of the Beltsville, Md., laboratory, has recently completed an analysis of the blood of the southern armyworm (Prodenia eridania Cram.). Some 27 substances were determined by various micro-quantitative procedures. Of these, sulphur was present in very high concentrations, but sugars fermentable by yeast and cholesterol were very low.

Inactivation of toxic principles of pyrethrum by insect tissues.--P. A. Woke, Beltsville, reports on the results of experiments made to determine whether the toxic principles of pyrethrum are inactivated in whole or in part after it has been ingested by the southern armyworm. This work was undertaken as a sequence to the work on the imported cabbage worm reported by Swingle (1934). Mosquito larvae were used in a biological assay method for determination of toxicity. The general conclusion is reached that the tissues of the southern armyworm possess properties capable of bringing about a high degree of inactivation of the toxic principles of pyrethrum.

Methods of rearing the southern armyworm.--Mr. Woke also reports a method of rearing the southern armyworm in large numbers for use in physiological and toxicological studies. The larval rearing cage is essentially a chamber, 36 inches wide, 24 inches long, and 16 inches deep, with glass sides, wood bottom, and frame and screen top, part of which serves as the door. Fresh potted plants are placed on sand in shallow trays in the bottom of the cage. Egg masses which have been deposited on waxed paper are fastened to the leaves of the plants. The larvae develop to maturity in the one cage and those not used in experiments pupate in the sand. The pupae are separated by immersing the sand in water and are placed in an oviposition cage where the moths emerge. Thorough disinfection of cages after each rearing is practiced and recommended. A continuous supply of larvae is provided by the use of four cages, one new cage being started each week.

INSECTICIDE INVESTIGATIONS

More concerning nicotine.--In the October 1, 1936, News Letter, vol. 3, no. 10, p. 30) attention was called to the compilation by the Division of Insect Investigations and the Division of Control Investigations, of a complete bibliography concerning nicotine, and notice was given that Part I, dealing with the chemistry of this compound, had just appeared. Part II of this work entitled, "A Bibliography of Nicotine. The Insecticidal Uses of Nicotine and Tobacco", under the authorship of N. E. McIndoo, R. C. Roark, and R. L. Busbey, is now available. It has been put out in mimeographed form as E-392 of the Bureau, and is in three separate sections comprising a total of 628 pages, in which are given 2,497 abstracts of articles pertinent to the subject. This completes the work that will be done by this Bureau, the collection of references to the medical aspects of nicotine having been turned over to the Bureau of Chemistry and Soils.

Patent granted on nicotine humate.--In the April 1, 1936, issue of the News Letter (vol. 3, no. 4, p. 18) there was described a new nicotine-containing insecticide developed in this laboratory by L. N. Markwood and called "nicotine peat." As a by-product of the manufacture of this insoluble compound there is obtained a water-soluble product consisting of a combination of nicotine and the humic acid of the peat. It can be obtained as a dry powder containing about 28 percent of nicotine. The Patent Office has now granted a public service patent on this material. It was issued January 5, 1937, as U. S. Patent 2066941.

A source of nornicotine discovered.--Nornicotine, a compound closely related to nicotine, having the formula $C_9H_{12}N_2$, has been known for some time, and recent tests by C. H. Richardson have shown the optically inactive synthetic material to have considerable insecticidal value. C. R. Smith, of the Division of Insecticide Investigations, has now found that nearly 1 percent of this compound exists in the form of the laevo-rotatory isomer in the plant *Nicotiana sylvestris*.

BEE CULTURE

Biometrical studies of bees.--W. J. Nolan, of the Beltsville, Md., laboratory, reports that of the characters he is measuring of bees, tongue length is the most constant. This is based on a total of many hundreds of bees of various strains. In addition to making some of the conventional measurements, measurement of the cubital index has been undertaken. This index is the ratio of the two parts into which a line through the third cubital cell cutting the cubital vein is divided by dropping a perpendicular from it to the second recurrent vein.

Poor quality of queens an important cause of supersedure.--C. L. Farrar, Laramie, Wyo., has summarized the causes of loss or unfavorable condition of queens in 760 commercial packages shipped from the South and kept under observation in the North during the past season. The causes of loss can roughly be classified under four headings: Failure in shipment or introduction, poor queens, inferior packages, and loss due to management at the receiving end. Of the four, poor quality of queens seems to be of first importance so far as the problem relates to supersedure.

Colonies show indication of resistance to American foulbrood.--A. P. Sturtevant and A. W. Woodrow, Laramie, report that six queens being tested for resistance to American foulbrood are being wintered over. Colonies headed by these queens were each fed ten times the minimum infectious dose of spores of *Bacillus larvae*. A small amount of disease developed in all colonies and later disappeared. The six colonies had previously shown disease-resisting characteristics.

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Nature of coloring matter in beeswax.--In work conducted in cooperation with the chemistry division of the University of California, G. H. Vansell, Davis, Calif., reports that a spectographic examination of color extracts removed from beeswax surprisingly failed to produce bands that coincide with the absorption bands of B carotene. Preliminary tests on the color solutions extracted from beeswaxes showed no absorption bands but rather continuous absorption from about 3700 A° into the ultraviolet. Squash pollen, however, showed five very definite bands lying in the region between 3700 A° and 4700 A°.

Large losses in queen-rearing yard.--E. Oertel, of the Baton Rouge, La., laboratory, has ascertained as a result of studies made in a commercial queen yard consisting of approximately 2,000 nuclei that less than 50 percent of the cells introduced into nuclei resulted in marketable queens. Factors that contribute to such losses are being studied.

IDENTIFICATION AND CLASSIFICATION OF INSECTS

North American moth occurs in Japan.--Among some insect material from Japan recently submitted for determination by R. W. Burrell, through C. P. Clausen, were certain Microlepidoptera obtained in corrugated board strips in which cocoons of Grapholitha molesta Busck had been exposed to parasitization in the field. The moths were identified by August Busck as the common Evippe prunifoliella Chambers, a pest of peaches, plums, and cherries. Apparently this species has not previously been reported from outside the United States.

Additional African fruit fly material for the national collection.--A collection of fruit flies assembled by R. H. Van Zwaluwenburg in the course of a survey conducted by the Bureau in West Africa during the past year was submitted for determination recently. C. T. Greene reports that it contains numerous Trypetidae of economic importance and of unusual interest not previously represented in the national collection. Series of species already in the collection have been also improved by the addition of material showing new distributional data. This fine lot of Trypetidae, combined with the even larger lot from East Africa mentioned in the last News Letter, has enormously enriched the Museum collections, especially in the genera Ceratitis and Dacus.

Box-elder bug in New Jersey.--This injurious pest in its rapid spread over the eastern United States appears to be established in northern New Jersey. Several specimens collected at Haddon Heights, N. J., December 28, 1936, by F. S. Ritchie and sent to the Bureau for identification, were determined by H. G. Barber as Leptocoris trivittatus Say.

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